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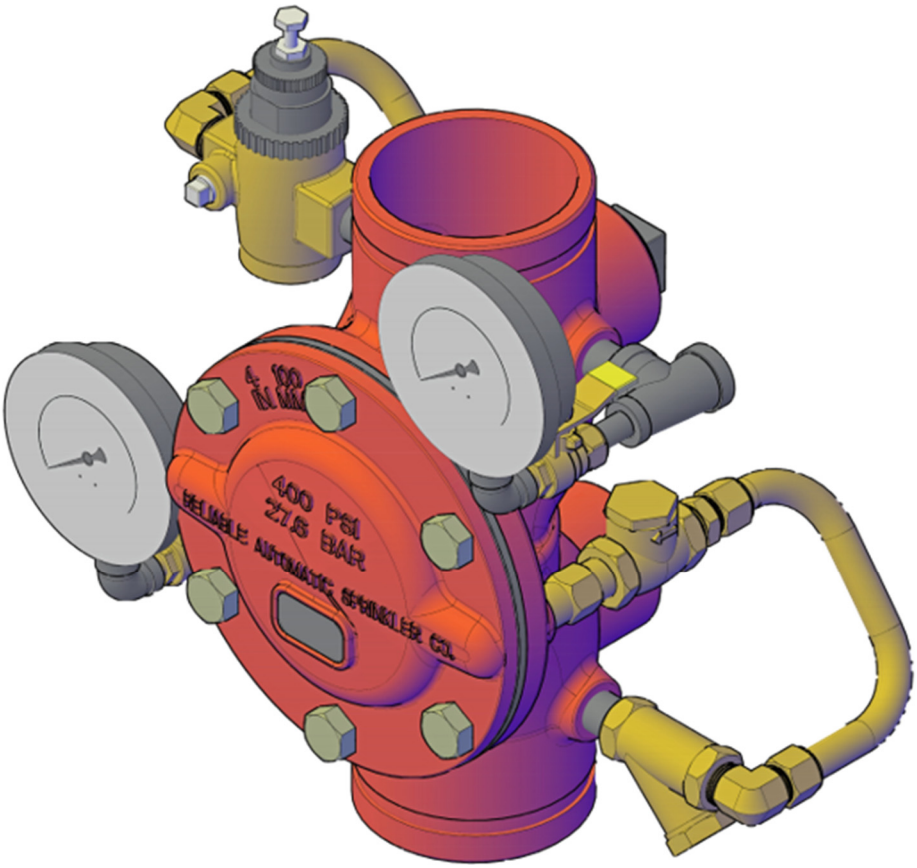

PRESSURE CONTROL DESIGN GUIDE

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1. INTRODUCTION

This Design Guide has been prepared by The Reliable Automatic Sprinkler Co., Inc. to provide a source of information that will help users understand and select Pressure Control components for a wide variety of fire protection applications. It is complemented by other Reliable Automatic Sprinkler Company design guides that provide more specific insight into supplemental equipment necessary to install a complete system. Note that separate design guides have also been prepared for other types of fire protection systems such as deluge and dry systems.

This guide will provide a comprehensive overview of Pressure Control systems and their operation while introducing the specific equipment necessary to complete the installation. For a detailed description of the specific equipment outlined in this guide, it will be necessary to obtain the appropriate technical bulletin. Where applicable, bulletin numbers have been included to facilitate a more detailed analysis and description of Reliable Automatic Sprinkler Company valves and components.

Note that the information included herein is only a guide. Responsibility for the actual design and installation of any fire sprinkler system rests with the engineer of record, certified layout technician and/or the Authority Having Jurisdiction.

For additional product information and other resources, please visit www.reliablesprinkler.com. Should you have additional questions about Reliable products, please do not hesitate to contact our Technical Services Department at 800.557.2726 or email us at techserv@reliablesprinkler.com.

2. DEFINITIONS

The definitions included in this document are as described in National Fire Protection Association (NFPA) standards where applicable. Those definitions are marked with an asterisk. Where no specific definition is available in the standard, Reliable terminology has been used to describe or define a process, product, or device.

Approved*- Acceptable to the authority having jurisdiction.

Authority Having Jurisdiction (AHJ)*- An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

Listed*- Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction.

Pressure Control Valve*- A pilot-operated pressure reducing valve designed for the purpose of reducing the downstream water pressure to a specific value under both flowing (residual) and nonflowing (static) conditions.

Pressure-Reducing Valve*- A valve designed for the purpose of reducing the downstream water pressure under both flowing (residual) and nonflowing (static) conditions.

Pressure-Regulating Device*- A device designed for the purpose of reducing, regulating, controlling, or restricting water pressure.

Pressure Regulator- A pilot valve used to regulate the downstream water pressure of a Pressure Control Valve.

Pressure Relief Valve- A valve that will open to allow excess pressure to be relieved form the system side of a piping network.

Pressure-Restricting Device*- A valve or device designed for the purpose of reducing the downstream water pressure under flowing (residual) conditions only.

3. COMPONENTS

3.1 Diaphragm

A dome-shaped fabric reinforced EPDM diaphragm is used to form a seal to the machined seat of the pressure regulating valve body. When water pressure builds in the control chamber between the diaphragm and the cover, the diaphragm is pressed against the seat to prevent water from flowing through the valve. The release of water pressure from the control chamber allows the diaphragm to deform away from the seat permitting water to flow through the valve.

3.2 Pressure Regulator

Water pressure on the downstream side of the diaphragm reaches the preset level of the pilot operated pressure regulator, which then closes and allows pressure in the diaphragm control chamber to build, forcing the diaphragm to seal against the seat. When pressure on the downstream side of the valve decreases, the pilot operated pressure regulator senses the lower pressure and begins to open and relieve pressure from the diaphragm control chamber. This in turn allows the diaphragm to move away from the seat and water to pass through the valve. The pressure regulator continues to sense the water pressure on the downstream side of the valve and adjusts to any increase or decrease in pressure to maintain close control of the flowing water pressure.

3.3 Pressure Relief Valve

Relief valves are intended for use to relieve excess pressure from fire protection systems and are required to be installed downstream of pressure reducing valves. The Reliable Automatic Sprinkler Company Model A Pressure Relief Valve is UL Listed and FM Approved.

The Model A Relief Valve is designed to operate between 95% and 105% of the nominal operating pressure. Select a relief valve with a nominal operating pressure up to 10 psi (0.7 bar) in excess of the maximum system pressure to avoid operation under normal system pressures.

3.4 Pressure Gauges

NFPA standards require that pressure gauges be included on the inlet and outlet sides of the pressure-reducing valve. 300 psi (20.7 bar) gauges are provided standard with the Model PRV. 600 psi (41.4 bar) gauges are available when maximum water pressure is expected to exceed 300 psi (20.7 bar)

4. DESIGN

4.1 General

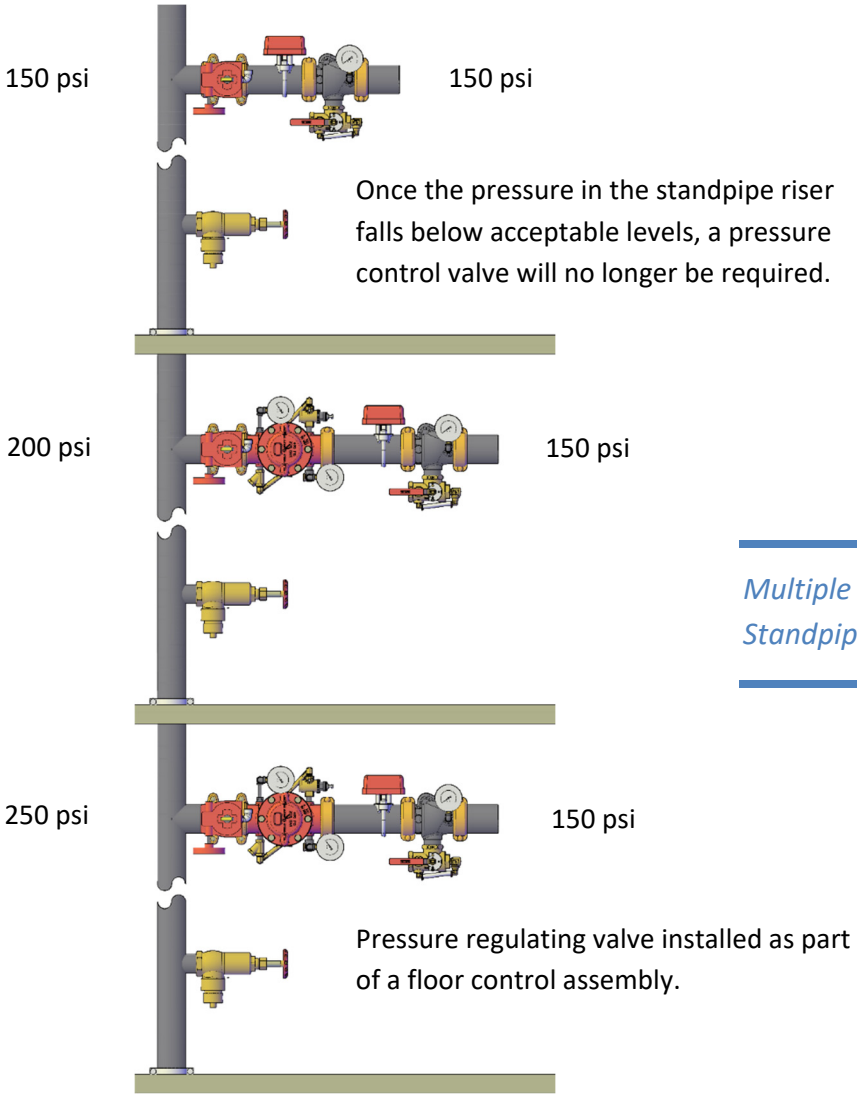
The operation of a diaphragm style valve is different than the operation of a traditional clapper style valve such as the Reliable Model DDX Deluge Valve. A clapper style valve is an “all-flow” or a “no-flow” valve. A diaphragm style valve, conversely, can be “modulated” through the hydraulic pressure in the control chamber. In this way, downstream (system) flow and pressure can be regulated. As pressure is relieved in the control chamber, the diaphragm will flex and allow supply side pressure through into the system. Note that the diaphragm does not necessarily FULLY deform; this is due to the pilot regulator maintaining some hydraulic pressure in the control chamber to adjust the flow and pressure downstream into the system. The degree to which the diaphragm will deform is a direct function of the amount of hydraulic pressure allowed in or out of the control chamber.

Rotating the adjustment screw on the pilot regulator in a clockwise direction will cause the regulator to slowly open, and this will allow more water out of the control chamber of the pressure regulating valve. The diaphragm is free to move, and flow increases through the valve increasing the downstream pressure. Conversely, rotating the adjustment screw in a counterclockwise direction will cause more hydraulic pressure inside the control chamber and therefore less outlet flow and pressure into the system piping. Once the final adjustment has been accomplished, the adjustment screw should be fixed in place using the locknut found on the adjustment screw.

As the system is opened and water flows through the valve assembly, the regulator adjusts to maintain the selected outlet pressure. When the system is shut down, water completely refills the control chamber of the Model PRV Valve, causing it to close. Due to restrictions in the regulator trim this closure happens slowly and acts to protect the supply side piping from a water hammer. While the control chamber is repressurizing, higher than desired pressure will most likely appear in the downstream piping. For this reason, NFPA standards require the installation of system side pressure relief valves. Once the control chamber closes and it is fully sealed, the pressure relief valves will operate and return the system side pressure to the desired setting. Engineers and designers need to keep in mind that the discharge from the pressure relief valves must be accommodated into the plan for drainage piping. In addition, provisions must be made for full flow testing of pressure regulating valves installed on a fire protection system. This may involve the installation of full-size connections and larger than normal drain piping.

4.2 Floor Control Application

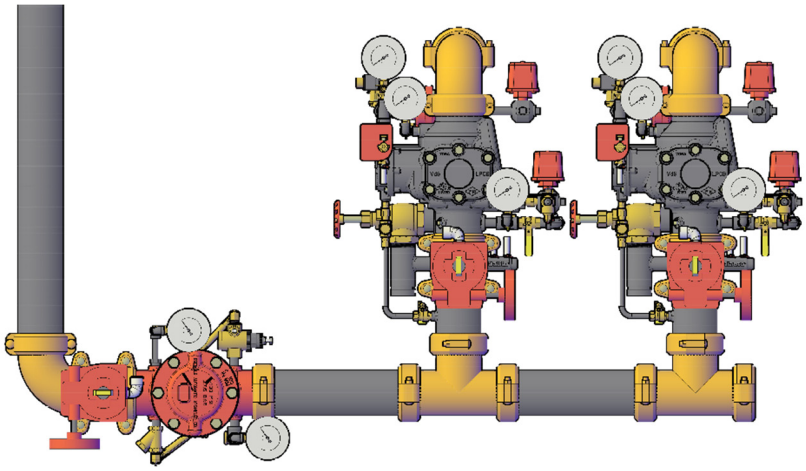
A typical "floor control" application might be found in a building with a high-pressure standpipe serving multiple floors. This installation may include hose valves and fire protection systems fed off a combined riser. The supply pressure provided at the lower levels of the building is too high either for the sprinkler equipment (in excess of 300 psi) or simply higher than the design requirements of the sprinkler system. The installation of the pressure regulating valve ensures that each floor will have the same available pressure regardless of losses in the standpipe due to elevation and friction loss. This allows the system designer to repeat the floor-by-floor design as the supply side pressure will be the same at each level as a result of the pressure regulating valve. Once the building reaches a certain height, pressure regulation will no longer be required because elevation and friction will have combined to lower supply pressures to a point where full supply side pressure may be used for the fire sprinkler system. Installation standards do require that when a pressure regulating valve is installed, there must be a system test outlet installed to test the valve at FULL system flow. This may involve a full-size outlet (capped tee) installed in the system piping, and design and installation of drains large enough to accommodate full system flow.



Multiple Floor Standpipe Example

4.3 Main Building Header / Riser Application

Pressure regulation may also be advantageous where system risers are fed by high pressure pumps or in other areas where supply pressures are higher than the design engineer intends. In these cases, a single pressure regulating valve may serve multiple risers in the same valve room or on the same valve header. The outlet settings of the pilot regulator installed on the pressure regulating valve will maintain constant pressure regardless of flow, up to the maximum capability of the pressure regulating valve.



Pressure Control Valve Serving Multiple Risers

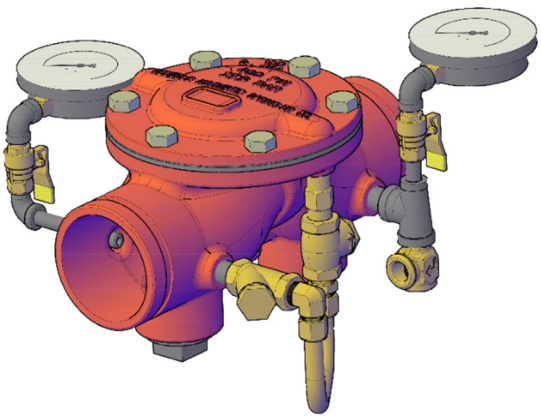
4.4 Open Nozzle/Sprinkler Application

Pressure regulating valves can also be used to regulate flow downstream in the system. By controlling the pressure in the control chamber of the Pressure Regulating Valve, downstream flow will be affected. When designing open nozzle or sprinkler systems, hydraulic calculations determine the necessary flow and pressure from the last open discharge device back to the regulating valve. The discharge pressure corresponding to the desired flow can then be set with the pilot regulator using the Cv Value of the Pressure Regulating Valve. In this manner, the open nozzles/sprinklers will create the desired pattern and water droplet size, resulting in improved coverage and proper protection of the design area. For foam-water systems, close control of total flow is also important to insure that foam concentrate is not expended too rapidly and that design durations are met.

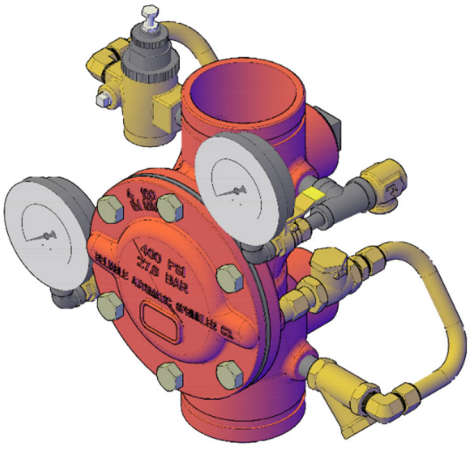
Spherical Tank
Open Nozzle Protection

5. INSTALLATION

Because diaphragm style pressure regulating valves so not utilize a clapper, the valve may be installed in any advantageous orientation. Vertical or horizontal installations are most common but not necessarily required. The system piping must be able to fully drain on both sides of the pressure regulating valve.



Horizontal Installation



Vertical Installation

DESIGN GUIDES AVAILABLE FROM

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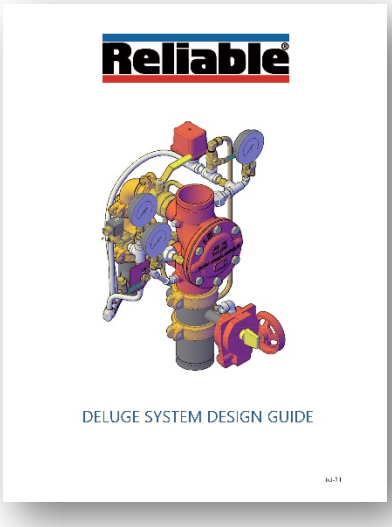

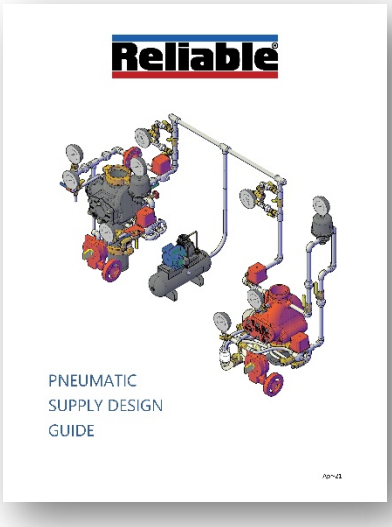

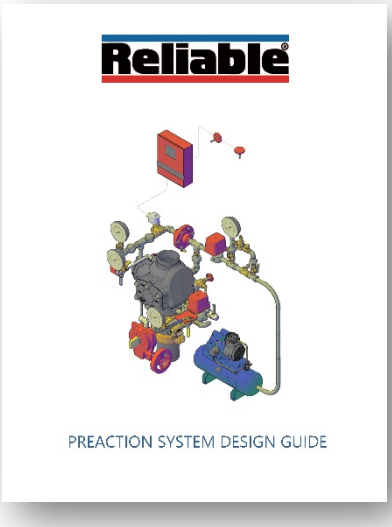

PLEASE CONTACT RELIABLE TECHNICAL SERVICES FOR ADDITIONAL SUPPORT

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